VTT Technical Research Centre of Finland

Preliminary Design of Remote Handling Connector and Ancillary Components

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Remote Handling Connector development

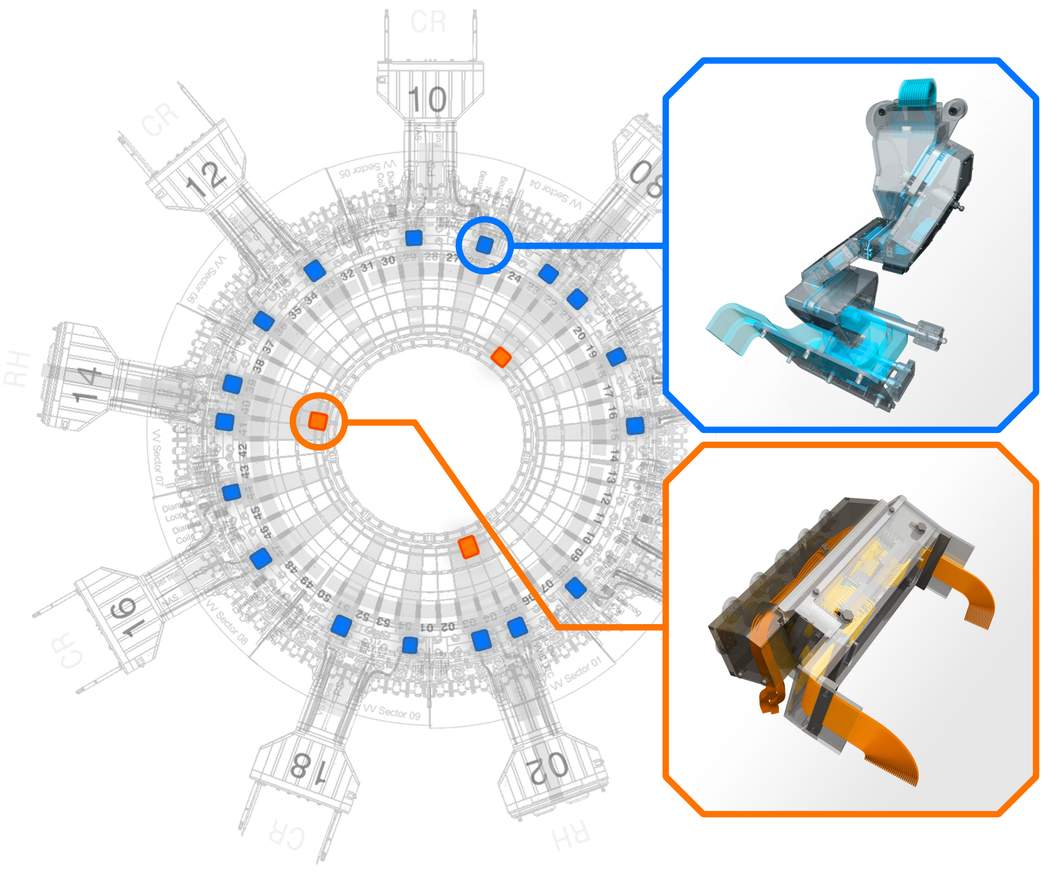
Remote Handling Connector (RHC) system is part of ITER in-vessel diagnostic components. The main function of this system is to route the electrical sensor signals from the divertor area up to the tokamak vacuum boundary. There are 16 diagnostic cassettes out of 54 divertor cassettes with different RHC configurations. The RHC system operates in high vacuum, high irradiation and high temperature conditions. The system is connected in a limited space via remote handling during the installation of the diagnostic divertor cassettes. Despite strict space limitations, the design of the RHC system considers proper remote handling capabilities and interfaces for in-vessel manipulator operations.

Design process

VTT has been working on the Preliminary Design of Remote Handling Connector and Ancillary Components. This continues the work done in the conceptual design phase of the system, where the architecture of the RHC system and the outboard and inboard configurations were decided.

Design

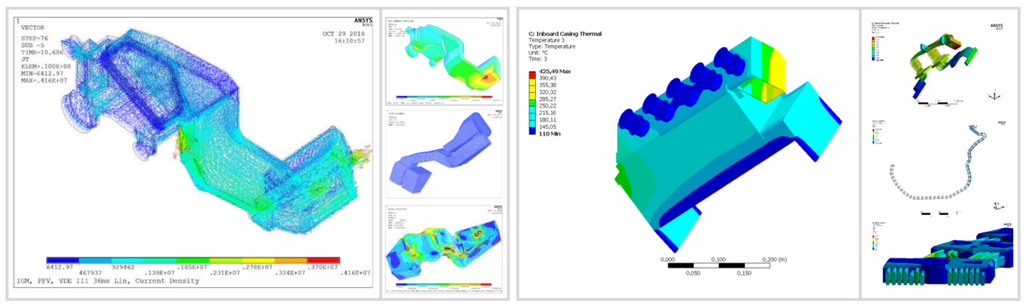
The preliminary design is highly impacted by finding an appropriate balance between the external and internal space limitations and system requirements. The design of the system has been an iterative process including mechanical design, thermal, magnetic and structural load analysis, risk analysis, and remote handling assessment.



Remote Handling Connector System: outboard (blue) and inboard (orange) configurations

Analysis

The electromagnetic (EM) induced forces and moments are calculated and transferred to the structural mechanical model. In addition to the seismic acceleration values and dead weight applied in the structural model, thermal model is also created to calculate the acute temperature distribution.



System load calculation and analysis for the outboard (left) and inboard (right) configurations

Prototyping

Manufacturing and testing mock-ups verified the design alternatives and adaptation to remote handling. Test environments included Divertor Test Platform 2 (DTP2) and Remote Handling Connector Platform (RHCP) in VTT heavy laboratory.

Outboard configuration mock-up demonstration in RHCP environment

Inboard configuration mock-up demonstration in DTP2 environment

Conclusion

System development followed the official ITER and F4E PDR processes. PDR review meeting was organized at the end of 2019. The current focus of the project is in the closure of the PDR phase by resolving chits raised during the review meeting. The scope of the PDR phase is to provide the baseline for the final design of the RHC system.

beyond the obvious

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